TROPICAL AGRICULTURE

THE OFFICIAL JOURNAL OF THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE

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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E.C. 3, England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Increasing numbers of inquiries are being received from various parts of the tropics which can be answered only by persons possessed of an intimate knowledge of local conditions. Enquirers should first satisfy themselves that their local Department of Agriculture is not able to supply them with the desired information before communicating with us. Correspondence which will be replied to is invited on all other matters pertaining to tropical agriculture, science and development.

PRICE STABILITY.

FOR several years the maintenance of a stable general price level has been of considerable academic interest. After the depression which succeeded the post-war boom, schemes were put forward from many sources, which had as their object the securing of a stable price level by manipulation of the quantity of money in circulation. The benefits of such schemes to the nation and to the consumer are clear and it is to be regretted that practical difficulties have prevented their adoption. If stability of the general level of prices were achieved, we should still be left with fluctuations of particular prices—commodities A, B and C may increase in price but the general price level will remain stable if the increase is compensated by a decrease in the prices of commodities D and E. Workers throughout the world are divided amongst different occupations and their welfare depends largely on the prices of the commodity they produce. As producers, then, their interest is in particular prices, and the stability of particular prices is no less important than the stability of the general price level. The prices of all products fluctuate from time to time, and, taking raw produce, one would certainly expect price changes from one crop time to another on account of differences of yield. One must not deduce because differences in yield occur that there is no conscious effort to control the amount of the yield. In planting his crop, the cultivator has in mind the prices for last season, the probable course of demand, and the possibilities of supply. Low price, falling demand, and adequate supplies will promote a reduction in the area or in the intensity of cultivation of that particular crop and *vice versa*. In many cases, allowances are made for fortuitous influences on the yield—for example, Sir William Himbury has stated that the present large American cotton crop is to some extent due to an unrealised expectation of denudation by the Mexican boll weevil. It is quite true that the supply of almost all crops is composite, consisting of portions from cultivators who have no knowledge of each other and who consequently cannot co-ordinate their efforts to keep supply in a reasonable relation to demand. External causes, however, have a weighty influence on the size of the crop—such incalculable factors as climatic conditions, the incidence of pests, problems of labour and transport are directly connected with the quantity produced. As price depends on the relation of supply to

demand, we must expect fluctuations in the prices of raw products. One may argue that there is nothing unusual in this; if growers lose when prices are low, they gain when prices are high and, therefore, should make a normal profit in the long run. That may be so, but there would undoubtedly be much less anxiety and much more smooth working of the economic system if that normal profit could be got by stable prices.

In order to realise some of the disadvantages arising from price instability, let us take the case of cotton. During the past season, cultivation has been very successful and large crops have been produced, but the cultivators will not gain. Prices, which fell from 10*d.* to 7*d.* (American middling) in the last quarter of 1926 are such that the total value of the present crop is less than that of last year. Inefficient farmers and unsuitable areas with high costs of production will be weeded out, but many cultivators with legitimate expectation of profit will suffer loss and transfer their attention to some other crop. So far as the development of cotton within the Empire is concerned, this last result is most unfortunate, and some local assistance is very desirable. Continuity of cultivation should certainly be encouraged; the producer then becomes more acquainted with the crop and its requirements and more interested in the development of improved methods. On the other hand the spinners are, for the time being, fortunate; they will be able to fulfil their forward contracts with cheap spot cotton. So far as they are concerned, gains from price fluctuations are fortuitous; they are manufacturers and expect to profit by selling yarn at a price covering cost of production and giving a fair profit. In many cases they discount the effects of price changes in raw materials by operations in the organised produce markets. They shift the risk of fluctuating prices on to the shoulders of the broker, who, with greater knowledge of the conditions of demand and supply, is better able to bear the risk. The manufacturer would be pleased to have a stable price for cotton, because, with a steady price, he would be able to devote the whole of his attention to technique and administration. With the present distribution of supplies of raw cotton, methods for maintaining stable prices are certainly difficult to devise, but similar problems have arisen in the past with regard to other crops and these have been met by control of supply, the control in these cases being dependent on some degree of monopoly. Although industrial history has had a tendency to make monopoly synonymous with exploitation, it is not necessarily so and the securing of price stabilisation is one of the beneficial uses of monopoly.

Consider the Stevenson Restriction Scheme which was adopted when the fortunes of the rubber plantations in the East were at a low ebb. The aim of the Scheme was a price that would be fair both to producer and consumer, and the method was that of releasing or holding up supplies. Since the inception of the Scheme prices have certainly fluctuated but probably less than they would otherwise have done; sometimes they have gone against the consumer but this has been due to administrative flaws rather than conscious desire for exploitation of the position. The Scheme proved beneficial to the planter by affording him a price that covered cost of production, and will be for the ultimate benefit of the consumer by promoting continuous attention to the cultivation and production of a commodity for which there is an increasing demand.

In Brazil, the disastrous effects of large coffee crops led to valorisation schemes—attempts to maintain a certain price by controlling releases to the market. As a result of these schemes prices held steady in spite of record breaking crops. Coffee holds such an important position in the Brazilian economic and financial fabric that to have left price to the force of circumstances would have been courting disaster. Recognition of the importance of even distribution of supplies throughout the year is no less important than stable supplies over a period of years and the recently organised Sao Paulo Coffee Defence Institute bears this in mind.

A valorisation scheme was also used by the Asociacion de Agricultores del Ecuador and this succeeded in stabilising the position of their cocoa trade.

For the last two seasons large sugar crops have been got in Cuba and it has been found necessary to use restrictive measures in order to secure a price that would cover cost of production. The object of the restriction is not exaction but to enable growers to avoid loss. According to responsible opinion it is regarded as a temporary expedient rather than a permanent institution and it is hoped that restriction may be avoided in future by the use of other means.

It must not be tacitly assumed that successful restriction in any particular case postulates success in another; economic, political and other factors may differ from one case to the other. Nor must it be gathered that restriction is regarded as a universal solvent for difficulties created by overproduction. There must be some rough adjustment between the activities carried on in the world, and loss or fear of loss is potent in preventing attention being paid to any activity when conditions are unfavourable. Those only will continue to produce who regard the margin between price and cost as a fair profit: inefficient producers or those producing under adverse conditions must necessarily recoup only small profits or turn their attention to other more profitable activities. On the other hand, it is undesirable that efficient cultivators should be exposed to fluctuations of returns on account of natural variations in quantity of the crop, and, at the same time, it is desirable that users of the crop should be saved the anxiety that comes from fluctuations of prices. Arrangements which provide for a stable and remunerative price are in the interests of both, and, where reasonable, should be given careful consideration.

RESEARCH IN THE TROPICS.

The Reports of Mr. Ormsby-Gore's missions to East Africa in 1925 and West Africa in 1926 unfortunately do not appear to have received the attention of the Tropical Colonies of the Empire, outside Africa, that they deserve. The details of the sections devoted to Forestry, Agriculture and kindred sciences may be applicable only to the areas with which the Reports deal, but many of the general principles that are enunciated are of universal application in the Tropics.

The scientific and technical services in many of our Tropical Colonies have not received sufficient support and encouragement and too often the complaint is heard that the vital significance to a Colony of the Forester, the Botanist, or the Agricultural Research Officer is not only not appreciated but is frequently misunderstood and occasionally ignored by people of influence in local affairs. Yet despite this lack of appreciation additions to the staffs of these services are being made year by year, although local opinion may be loud in its denunciation of the expense incurred on account of the officers already serving. The Government at Home, however, and those responsible for the administration of the Colony, together with those most deeply interested in its present and future needs, are well aware of the price that has had to be paid owing to ruthless devastation of the natural resources of a country, and are rightly determined as far as may be possible to prevent further repetitions of so disastrous a nature.

It is, alas, easy to picture the case of a newly appointed officer who arrives in a Colony filled with enthusiasm to carry out the work of his post and then suddenly comes upon a local stratum of apathy or even positive antagonism. It is only natural that he becomes keenly disappointed and often discouraged and welcomes any assistance that will help him and seeks eagerly for some outside authority to come to his aid so that he can devote his time and energies to the work which lies before him.

In Mr. Ormsby-Gore's Reports will be found a large measure of comfort, for his recommendations are unprejudiced and are the result of personal enquiry on the spot. Throughout his Reports he lays great stress on the value of research into problems dealing with plants and plant-life in the Tropical Colonies, and he makes a special point that the scientific and technical departments of the Colony even in times of financial stringency, must be maintained so that full advantages can be taken of their investigations both at the moment and even more so when a more favourable opportunity occurs.

No one would wish to suggest for a moment that our Colonies are of value only for immediate gain to be computed in pounds sterling. Our duty therefore is to ensure an inheritance for posterity at least as valuable as that which has been handed down to the present generation. Yet, with the increase of population, the cessation of internecine strife, and the consequent greatly increased demands made on the natural resources of the Colony impoverishment will most surely result unless exploitation is scientifically carried out, fostered and encouraged.

There are still, for instance, many parts of our Tropical Empire of which no record of the vegetational assets has been attempted, a condition of affairs which would not be tolerated for a moment in the business world. An investigation of the local vegetation will certainly not bring immediate revenue, but can work of this nature be dispensed with on that account when it has been proved, wherever this work has been done, that valuable results have followed? Systematic record, and scientific study are necessary preliminaries to any scheme of exploitation. It is essential to record the existence and quantity of a kind of vegetation if it is to be dealt with intelligently and to the greatest advantage of the local community. It is equally necessary to study its behaviour and potentialities before it is rashly and often disastrously exploited, whether it be forests for timber and natural produce, or grasslands for pasture. Even when areas covered by natural vegetation are to be utilized for agricultural purposes a careful study of their nature and the behaviour of the vegetation is essential in order to form an accurate judgment of the possibilities of the land.

Again the individual plants composing the vegetation must be recognised and described according to some generally acknowledged system, otherwise the work of one individual is unintelligible to a fellow worker and that of one country to another. Without a careful enquiry into and a record of the plant-life of a country no real progress can be made in the development either of its agriculture or its forestry. Such study cannot be assessed in exact monetary terms, and it is only when its bearing on applied sciences can be demonstrated that its value to trade and commerce receives due recognition. How often, for instance, has a plant thought to be valueless suddenly sprung into economic importance with a resultant request by a Colony for a supply of seed, when it is found by the scientific expert that the plant in question is actually a native of that country. Then again a request for some plant of economic importance may be made to a Colony of which it is known to be a native and yet there has not been anyone in the Colony competent to recognise it. Needless alarm has also been caused through popular ignorance, in cases where cattle or even human beings have been supposed to have been poisoned by eating some local herbs, with the result that pastures have been abandoned and villages deserted. The education of farmers and of the public generally so that they may recognise their local plants and distinguish those which are of use from those which are harmful is thus another instance of the important service that can be rendered by the systematic study of the local vegetation. Work on budding, grafting

and plant-breeding has shown, in many cases, the importance of local plants, thoroughly acclimatised and immune to disease, as stock for experiment with new introductions: a knowledge of the local flora is a necessary preliminary to any work of this nature.

This reference to the introduction of plants from other countries calls attention to the popular idea that any desired economic plant when introduced will readily become established and that it will be possible to raise a large stock in a short time and put considerable areas under cultivation. Those who know of the thousands of introductions that are annually effected and yet how few succeed after years of trial will realise how erroneous and even mischievous such ideas may be. It is a far better policy to seek out valuable plants from among the local vegetation which has persisted after a long and intensive period of "natural research" rather than attempt what appears to be a short-cut with new introductions until their value has been fully demonstrated by careful experiment. With timbers and minor forest produce this "get-rich-quick" policy is much in favour, and considerable expense has been incurred in financing importations which might well have been devoted to investigations into the proper utilisation and exploitation of the natural forests of the country. Investigations of this nature must be made in a scientific manner for otherwise valuable natural resources will be dissipated and disastrous effects will ensue which will be felt for many generations. It must be remembered that a heavy price has to be paid and a long period must elapse, in order to win back to forest and forest produce, land which should have been passed on as a valuable forest-clad inheritance. It is perhaps natural to find in the smaller Colonies, and more especially Islands, where public finance causes some anxiety, a disinclination to expend money either to maintain a trained scientific staff or for the purposes of investigation and research. The natural resources are thought to be insignificant, and then it has always been so easy to import what is required! Little attention, however, is paid to the fact that among these imports there are almost certainly plants which could be produced locally and at the saving of much expense.

A disinclination to spend money on research quickly passes into an attitude of indifference and a general lack of interest in the fate of the local vegetation with the result that exploitation and destruction go unchecked and disastrous results must inevitably ensue. Local environmental factors alter, physiographic changes occur and crops fail with the removal of the natural cover of the soil, and eventually it is an impoverished country that is left with an ever-dwindling population. The only plea put forward in support of such an improvident policy is that the financial circumstances of the country cannot permit expenditure on scientific services where no direct financial return can be shown. Professor Baker, Dean of the College of Agriculture, Los Baños, Philippines, a recognised authority on tropical agriculture, has expressed this spirit in a recently published address. "We talk of the material development of the Philippines" he says "as if it was a matter only of business —of attraction of capital. We should not forget what the years have clearly taught in America and Europe, that there can be in the long run no safety in agricultural investment without the essential technical-scientific-service that may throw light on every problem, and may furnish the only reasonable insurance and security that agriculture—'the greatest gamble on earth'—may have. After needed and adequate knowledge is secured, it must then be taught to the whole population through every educational means available from lowest to highest."

Mr. Ormsby-Gore's remarks in his Report on his East African tour are equally emphatic. "We were encouraged to find that there is a growing demand on the part of the unofficial Europeans in East Africa for the services of scientific and technical experts in connection with crop production, animal husbandry, the exploitation of minerals and forests, the conservation of water supply, the improvement of existing industries, and the development of new ones." "We found" he goes on to say "that the official classes are beginning to realise that the scientific services are not a luxury to be dispensed with in times of financial stringency, but rather a necessary preliminary to production and development in the territories." The remarks in his Report on West Africa in connection with Agriculture are equally applicable to the Forest Services. "In the past the status of the Director of Agriculture and his Department has been too low . . . It must now be recognised that the heads of the Agricultural Departments are quite as important as the heads of many other Departments."

"If we are to develop our Tropical possessions we have got to realise the value of the scientific staff both in the laboratory and in the field, and we must provide careers in the Agricultural Departments in the Colonies which will attract personnel possessed not only of high technical qualifications but of capacity of leadership and ability to inspire others."

The key to the problem is undoubtedly the cultivation of an instructed public opinion. Where pains have been taken to place before the people themselves the aims of the technical services, support and sympathy have been forthcoming. Before this can be done, however, the services of competent and trained officers must be secured, and investigations into the natural resources of a country adequately carried out. Sufficient data will then be available on which an opinion can be formed as to how far and in what directions future developments can be undertaken. Until such information is available it is the duty of those entrusted with the present and future welfare of a country to see that the necessary preliminaries are carried through and that full encouragement is given to those entrusted with the investigations.

STUDENTS OF THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE—SESSION 1926-27.

Front Row :—Messrs. R. G. Heath, T. D. Rutter, J. A. Craig, H. B. Springer, J. S. Moerdyk, J. E. Symond, V. F. Olivier, C. Harvey, E. F. Martin, L. G. Bentall, A. de K. Frampton.

2nd Row :—Messrs. C. O. Oates, (the late) O. L. Thomas, C. L. Newman, K. T. Hartley, H. L. Grogan, F. McG. Bain, G. L. Spencer, R. M. Steven, T. L. Williams, M. A. Aspiazu, R. S. Hanomansingh, A. A. Reece.

3rd Row :—Messrs. H. Musk, J. A. Potter, D. W. H. Baker, D. MacDonald, P. A. Bowmaker, A. E. W. Sheffield, A. C. Palmer, O.V. S. Heath, M. Greenwood, J. G. Davies, L. S. Birkett.

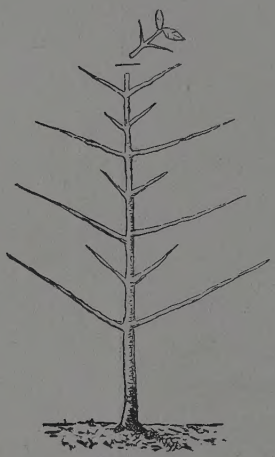
Back Row :—Messrs. J. A. McDonald, J. L. B. Kincaid, H. K. Hewison, L. H. A. Stone, W. P. K. Findlay, J. G. Reynard.

Absent :—Messrs. W. V. Harris, M. Afzal, S. J. F. Dias.

Pruning of Coffee.

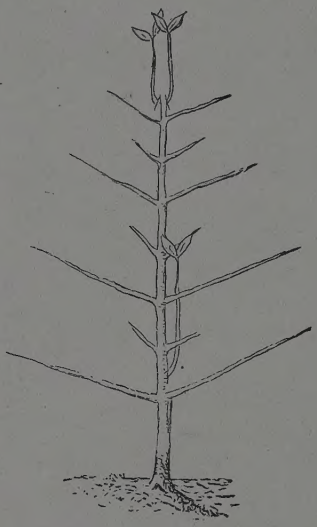
See page 65.

Fig. 1.



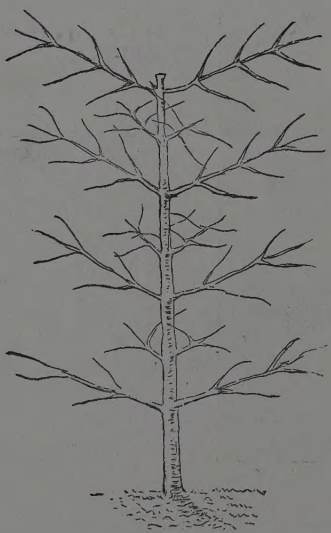
Topping.

Fig. 2.



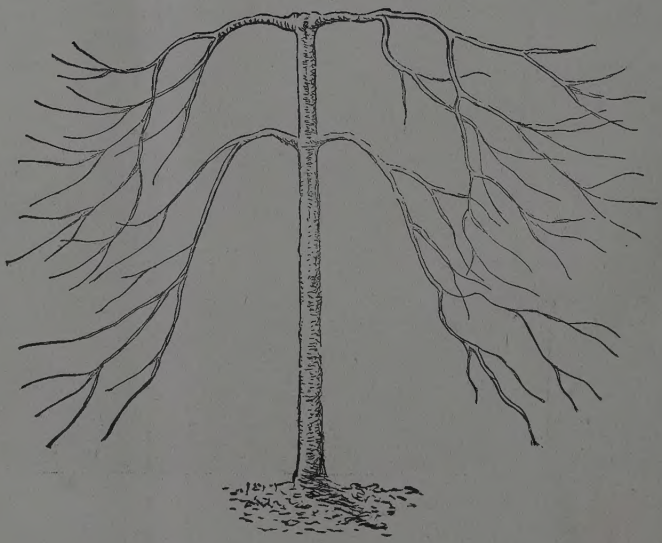
Removal of chupons.

Fig. 3.



Well pruned tree about 6 years old.

Fig. 4.



Pruned and well-cared tree from 8 years of age.

PRUNING OF COFFEE.

Mr. Carlos E. Chardon, Commissioner of Agriculture and Labour of Porto Rico, after a visit to the Republic of Colombia has written an instructive article on the pruning of coffee in the *Revista de Agricultura de Puerto Rico*, Vol. XVIII, No. 1, pp. 7-13, the main points of which are dealt with in this translation.

Pruning was started in Costa Rica, and was afterwards much developed in Colombia. To-day the practice is almost universal. It should be remembered that Colombian coffee estates are almost exclusively planted with Arabian varieties, to which these practices are specially applicable.

The reasons for pruning are: 1. To reduce the woody part of the tree and to increase the bearing parts (lateral branches) and hence to turn to better account the vital energy of the plant. Unpruned trees are a mass of stem, branches and leaves, and do not bear much fruit.

2. Pruned coffee trees, being about 5 feet high, are easily cropped and the plant is not injured while cropping is done. (Trees not pruned grow as high as 10-13 feet.)

3. Coffee is a plant which tends to bear its fruit on the higher branches and in trees not pruned the stem bends with the weight of the fruit. In the arch thus formed a great number of chupons arise, but this does not happen on pruned trees.

4. The plantations are evenly established, and therefore lend themselves easily to better cultivation and sanitation.

There is a first pruning or topping (Descopada) and a second (Deschuponada). At about 4-5 years of age the plants are higher than 5 feet, and this is the best time for first pruning or topping—usually after the first crop. (fig. 1.)

The height at which the plant is to be topped varies with conditions, but it is commonly at 4½ feet from the ground. Topping is done by means of pruning scissors.

In poor soil, trees are small and are topped at 4 feet from the ground. In rich soils topping is done at 5½ feet and even more. In zones liable to hurricanes the trees are topped as low as possible.

As a result of this topping, there is an increase of secondary and tertiary branches and hence of production; but chupons, which are very undesirable, arise on the stem, and a second pruning is required. The removal of chupons has to be done by pulling them off with the hands in order to make a big scar on the point of attachment. The use of scissors or knives causes a greater number of chupons. (fig. 2.)

If good results are to be obtained, the plants ought to be gone over frequently and regularly and all the new suckers suppressed. The results of the removal of suckers are seen after two years. There is a great reaction on the plants, which, being in wonderful condition, bear fruits abundantly because the lateral branches have developed, while the length of the stem has not increased but has become somewhat thicker, making the plant much more solid. Most of the energy of the plant will have been spent on the production of flowers and fruit (fig. 3). Henceforth, crops will increase in proportion to the increase of lateral branches (up to a limit). If plants are allowed year after year to accumulate too many branches, the productive surface of the plant will become a bushy mass keeping light and air away from the plant. Air is essential and has to circulate inside and around the plant, otherwise bad crops will follow. Consequently, every 3 or 4 years a general cleaning up of the plant and cutting off of undesirable parts is required. The lower lateral branches are usually removed—by means of scissors— leaving on the plant only the younger branches (about three-fourths of the branches are removed); and the trees are left in skeleton form. At the same time lichens and other epiphytes are removed from the stem by means of a corn-cob soaked in lime-water; in this way, the old bark, where ants, borers, &c., hide themselves, is removed. When this is done it is advisable to manure. Manurial treatment depends on the soil, and there is still a good deal to be learned about good manures for coffee. Manuring adopted on plantation "La Suiza" in Colombia, the soil of which is of volcanic origin and rich in potash is a mixture of three-fourths ground bone and one-fourth sodium nitrate, one lb. of the mixture being applied per tree.

When the trees are 8 to 10 years old their stems should be about 2½-3½ inches in diameter and only the two upper pairs or ranks of branches should be on the tree —usually only the upper one—as all the lower branches should have dried up long before, and, being barren, should have been removed. The upper pair of branches is the basis of the branching system, which, in a properly pruned tree, should nearly reach the ground. (fig. 4.)

Between the stem and the hanging lateral branches there should be a zone for free circulation of air. This is attained by a symmetrical and well planned system of pruning.

The value of these methods is seen by a comparison of production in different places, from the returns shown by four estates in Colombia with a total of 1,030,000 trees, it seems that the average production during the last five years is 800 lb. per cuadra.

In Porto Rico the average production is 185 lb. per cuadra.

An article in the *Times Trade and Engineering Supplement* on "A Tour in the British West Indies" mentions that "In Trinidad at the moment the College of Tropical Agriculture is of outstanding importance; it is an institution fraught with vital consequences to the whole of the British possessions around the Caribbean Sea, and must not be dismissed in a few lines; it had better be reserved for discussion in a subsequent article." This article will be reproduced in the next number of this Journal.

SULPHUR DIOXIDE OF SUGAR.

Determination of.

By R. H. HURST, PH.D., B.SC., A.I.C.

THIS subject has been investigated with a view to finding the method most suitable for adoption in cane sugar factories.

The lead sulphide stain method devised by Mr. J. S. Mann, of Messrs. Tate and Lyle, Ltd., and described by Ogilvie (*International Sugar Journal*, December, 1926, p. 646) has given very good results. The standard stains are oxidised on exposure to air and so do not retain their original colour, but the stains corresponding to 25, 20, 15 and 10 parts of SO_2 per million differ sufficiently in depth of colour to be memorised after a few determinations have been made.

The ordinary titraton method with iodine solution in the burette has been found to be entirely untrustworthy. Using this method a sample of grey sugar which had not been sulphured had an apparent SO_2 content of over 100 parts per million, and many samples of yellow crystals had an apparent SO_2 content over three times as large as the true content.

Acidification of the sugar solution with a few drops of hydrochloric or acetic acid makes a remarkable difference and leads to a very much earlier and clearer end-point.

In the writer's opinion, however, the most reliable titration method is the following :—5 grams of the sample of sugar are dissolved directly in an excess (say 20 cc.) of standard iodine solution to which have previously been added a few drops of hydrochloric acid. The sulphite is thus oxidised quantitatively to sulphate, and the excess iodine is determined by titration with standard sodium thiosulphate solution. The indicator, starch solution, should be added as late as possible so as to avoid precipitation of starch iodide.

If this procedure is carried out carefully it can be said with confidence that the sugar does not contain a greater amount of SO_2 than that given by the experiment, though it may contain a slightly smaller amount. The results obtained have been found to agree very well with those given by the sulphide stain method.

For sugar factory procedure it is sufficiently accurate to make up the standard iodine solution from a weighed amount of iodine as follows: About 2 grams of potassium iodide are dissolved in as little water as possible in a weighing bottle, and this is weighed. About one gram of iodine is added and the stopper or lid of the bottle replaced immediately and the weight is again taken. When the iodine has dissolved, the solution is run quickly into a 500 cc. graduated flask containing about 1 gram of potassium iodide dissolved in water and the solution is made up to the mark. The sodium thiosulphate solution is standardised from this iodine solution, the thiosulphate being placed in the burette. The standard thiosulphate should be kept in the dark in a blue Winchester bottle, and should, for safety, be restandardised at frequent intervals with a freshly made iodine solution. For use in an experiment the iodine solution may be diluted with water containing a little potassium iodine so that 1 cc. contains 0.0002 grams of iodine, *i.e.*: corresponds to 0.00005 grams of SO_2. In all cases freshly boiled (and cooled) distilled water should be used.

It may be stated here that the various samples of Trinidad yellow crystals with a fairly large grain which have been examined, have usually been found to be very easily within the limit of 70 parts of SO_2 per million, many of them, indeed, containing less than 25 parts per million.

WEST AFRICA.

The Report (Cmd. 2744) by the Hon. W. G. A. Ormsby-Gore, M.P. (Parliamentary Under Secretary for the Colonies), on his visit to West Africa is a valuable piece of work, useful not only to those interested particularly in West Africa, but to those interested generally in problems of the tropics. One looks for and finds evidence of keen observation; the views expressed are distinguished by a sanity of outlook shewing an appreciation of special difficulties, and, furthermore the study is not merely static in its opinions and recommendations, it shows considerable pre-vision, *vide* the chapters on "Transport and Communications" and the "Palm Oil Industry." The surveys of conditions in Nigeria, the Gold Coast, Sierra Leone and Gambia are condensed in the "*Tropical World Notes*" of the Journal and here it is proposed to deal with those chapters of the Report which are of a more general nature. Throughout, insistence is laid upon the application of science to Tropical development and it is recognised that continued progress in the production of economic crops for export depends on the improvement of four things :—transport; the condition of public health; agricultural methods together with animal husbandry; and lastly, native education.

Transport.

In the development of any country the importance of good communications cannot be over-rated and in the tropics particularly are all other economic questions subsidiary to and dependent on good transport facilities. Cheap and easy transport is vital for keeping order, for the marketing of produce, and for increasing the labour supply by relieving large numbers from the work of porterage. Roads and railways imply docks and wharves and the inception of an era of public works which makes an area on the earth's surface into a colony. The words of the Report are quite definite in their appreciation of this situation. "The development of Africa depends so largely on the extension of transport facilities that transport problems are of primary

importance. Without transport facilities there can be neither adequate administration nor commerce." Africa has good examples of expansion and stagnation due to the development of transport. The cocoa industry of the Gold Coast "has been due in the main to the development of motor road transport," and the extension of the railway from Baro on the Niger to Kano completed in 1911 by Sir Percy Girouard, "has been the direct cause of an ever expanding production of cotton and ground-nuts over a large and still increasing area." On the other hand in the province of Ogoja (S. E. Nigeria: population 600,000-700,000) which has not yet been opened up, there is little trade and officials must spend a large part of their time in moving slowly on foot from village to village."

"One of the first duties of all Governments in Africa is to plan and execute a continuous programme of transport development . . . there must be no question of water transport, railway transport, and road transport being regarded as watertight compartments. All these systems must be envisaged as one whole, and all must be based upon the sea." With the exception of the Gold Coast there are good natural harbours which are being steadily improved. "All traffic on the Gold Coast has to be conveyed to and from ships lying in open road-steads, and all the shore work at Accra and the smaller ports is done in native surf boats under the most difficult and often dangerous conditions." Good harbours are useless unless ships can be cleared quickly and can turn round in the minimum possible time; hence the provision of good terminal facilities is of equal importance. Next comes the development of transport facilities from the ports to the interior. The Niger River, the Benue, the Cross, the Gambia River and the river systems of Sierra Leone enable these places to use the cheapest and best form of inland transport, but this is lacking in the Gold Coast, the rivers of which are not accessible to sea going vessels on account of insurmountable obstructions at their mouths. Where inland water transport is absent railways are essential for long distance traffic, and in West Africa rail transport is in its infancy and entirely inadequate. Gambia it should be noted has no railway and does not require one. Feeder roads to the railway system are quite as important as railways themselves and here, with the possible exception of the Gold Coast, West Africa again lags behind requirements. Roads constructed must be capable of being used by mechanical transport, and the construction of motorable roads in British West Africa presents many difficulties. With high annual rainfall of a torrential character, rivers and streams rise and fall with great rapidity, consequently, the main item of cost is bridging, but over and above cost of construction and maintenance of bridges is the problem of road surface in African conditions. Road metal is scarce and expensive and in some parts where laterite is not obtainable roads are merely earth surfaced, so that the speed and axle load of vehicles have to be limited. "Development . . . lies in the direction of increasing the quantity of produce carried . . . without increasing the axle load." Head porterage, which is still quite common in all the colonies and universal in Sierra Leone, is inefficient and expensive—comparative costs of different forms of transport works out as follows:—Head 2*s.* 6*d.* per ton mile; motor, 1*s.*; donkey, 11*d.*; camel, 9-10*d.*; railway, 2*d.* Quite apart from cost, however, roads have an incalculable civilising effect and it is helpful to find the natives are keen on road development.

In dealing with questions of ownership and railway rates, Mr. Ormsby-Gore touches on problems, the significance of which is of wider application. Lack of local knowledge makes control from England difficult, and this, together with the fact that it is unlikely that there will be any permanent European residents with the time or experience to vote to director's duties makes control difficult. With regard to finance the important—but not always conceded—point is laid down that "Railway Department accounts should be kept separate from the other colonial accounts." So far as rates are concerned, Mr. Ormsby-Gore states that they should be fixed so that "all expenses are covered, including interest on capital expenditure and sinking fund, as well as renewal fund payments, "they should be neither revenue earning nor a charge on revenue." This may accord best with African conditions, but there are cases where low rates would assist in the development of trade and so habituate people to the use of rail transport that loss might be quickly followed by gains larger than these to be got by an immediate fixing of rates covering cost. The suggested conferences of officials and comparative studies of the systems in other lands should tend to increased efficiency.

Public Health.

In matters of health, West Africa—"The White Man's Grave"—has had, in the past, a not undeserved bad reputation. Tropical conditions can be bettered by good housing, sanitation, provision for recreation and relaxation, and fresh and varied food. "In the past, in West Africa each and everyone of these ameliorating conditions has been altogether lacking. Although West Africa has not become a health resort, the beneficial effect of precautionary measures is seen by a glance at the vital statistics:—In 1903 the death rate of the European officials was 20.6 per thousand and the invaliding rate 65.1; in 1924 the respective rates were 12.8 and 21.7. "There is no part of the world where the same combination of heat and moisture together, with a conspicuous absence of cooling breezes is found. In addition, the sun's rays appear to have more effect in West Africa than elsewhere in the Tropics . . . In West Africa officers can get little or no change from work and the atmosphere of work, and the opportunities for sport are far fewer than in East Africa. Further I found it the general opinion of Medical

Officers that in West Africa local leave is, under present conditions, in many cases worse than useless."

Naturally, under such circumstances, leave conditions are important and two suggestions are made. "The first is that every officer during his first two tours should be required to be examined by a Doctor as soon as he has completed twelve months' service in West Africa, and a special report on his general condition should be furnished to the Governor. Secondly, Medical Officers should be clearly instructed that in making recommendations for leave on Medical Certificate, regard must primarily be had not to a definite disease, but to an officer's general capacity to continue to perform his duties without deterioration."

In a paper read at a meeting of the Royal Colonial Institute, Mr. Ormsby-Gore summed up the general situation with regard to public health in the following words "The problem is obviously not primarily one of the treatment of the sick, nor even one of restricting the spread of epidemics, but is essentially that of maintaining health and increasing physical efficiency. Sanitation and nutrition play an important part in this problem.

Agriculture.

Although West Africa has mineral assets, economic progress depends on the development of the agricultural and sylvicultural resources. With regard to the type of crop Mr. Ormsby-Gore states. "The foundation of sound agricultural policy must necessarily begin with the production of the food of the people. Food comes first, and economic crops for export should come second . . . The main food of the population consists of root crops such as yams and cassavas, with a high content of starch, but deficient in other essentials. For continuous work such foods are an inadequate substitute for cereals." Although "a certain amount of fresh food, and particularly fresh vegetables, is essential to health . . . Tinned foods, and especially tinned vegetables and meat, form a large part of the diet of the European population resident in West Africa."

Physically, the area can be divided into three zones particularly clearly defined in the case of Nigeria; the coastal belt, with an average annual rainfall of from 150 to 170 inches, "is characterised by the presence of high timber forests and the prevalence of the oil palm." The cocoa belt, with a rainfall of 70 to 100 inches, runs along the sixth parallel of latitude. "In the northernmost belts the dominating economic crops are American-type cotton (Allen) and ground-nuts, and only in this northernmost belt are found any large numbers of cattle, sheep, and goats."

Agricultural methods vary from south to north. In the south predatory shifting cultivation is practised; yams and cassava are grown for one to three years, and the land is then abandoned for five to seven years. Abandonment is the only form of soil regeneration. In the North, around Kano, there is continuous cultivation and rotation of crops, and knowledge is displayed of the value of animal and green manure. Stress is laid on the importance of cattle in relation to agriculture generally, and it is pointed out that in Northern Nigeria a special feature militates against the joint development of animal husbandry and land cultivation; the cattle owners (Fulani) and cultivators (Hausa) are two different peoples, and the latter have to offer some inducement to the Fulani to bring their cattle on to the lands of the Hausa. With regard to implements, it is stated that "the plough is as yet unknown to the natives of West Africa, and cultivation is done with the hoe."

"Cultivation in Northern Nigeria is practically limited to the short wet season. Not much has been done as yet to utilise the perennial streams or the rivers for the production of irrigated crops during the dry season . . . One of the first requirements . . . is the advice and assistance of an agricultural engineer with a knowledge of the irrigation systems of the East."

"Northern Nigeria is developing as an important source of cotton supply. A type of American cotton of good colour and staple is now firmly established in the Provinces of Zaria, Kano and Sokoto." Some official support is recommended :— "In my opinion the Government of Nigeria should do all it can to facilitate the erection of new ginneries in the cotton areas. A full power press is to my mind essential, half-pressed bales being bulky and unsatisfactory." In the South attempts to grow American cotton have been unsuccessful and the Agricultural Department is experimenting on improved native cottons.

The Northern Territories of the Gold Coast are physically similar to North Nigeria, and with railway construction there is scope for the development of cotton and ground-nuts.

"The Gold Coast and Ashanti are at the present time entirely dominated by cocoa," nearly all suitable land has been brought under cocoa except in the Western Provinces of the Colony and Western Ashanti, but labour is scarce in those parts. In the Eastern Province where the industry has been long established there is a falling off in production per acre. "How far this is due to senility and how far to exhaustion of the soil is not yet clearly established . . . Little or nothing has been done in the way of manuring, and it may well be that the native farmers will have to adopt more scientific methods if they are to maintain their past yields." Local foods grown in the Gold Coast are yams, plantain, bananas, maize, guinea corn, millet and many kinds of bean.

In Sierra Leone the basic crop is rice of the "hill" variety, poor in yield and inferior in quality. "The oil palm grows intermittently" and "is for the most part a variety of oil palm with a much lower yield of oil than the usual Nigerian tree."

"Gambia . . . is in the natural ground-nut belt of Africa . . . rice is also important."

Owing to the ravages of the tsetse fly, there is a scarcity of cattle in British West Africa outside the Northern Provinces of Nigeria and the Northern Territories of the Gold Coast and "the lack of meat, milk and manure, as well as the lack of animals for transport, is a big factor." The cattle are brought down on hoof to the coast for slaughter; "the average loss is not less than 50 per cent., and the animals which reach the coast arrive in wretched condition."

Towards the end of this chapter Mr. Ormsby-Gore gives some well considered proposals with regard to agricultural organisation. "A sound Agricultural Department must contain three essential elements. First, a scientific staff at headquarters working directly under the Director of Agriculture at the problems set by him. This staff will consist of agricultural chemists, botanists, entomologists and mycologists. Biochemists would also be a help. As far as possible this scientific staff should be at one station working in one group of laboratories. Such research should be centralised. Further it should be co-ordinated—not merely between the four West African Colonies—but with similar research which is to be carried on in Trinidad and at Amani in East Africa . . . In addition to this central organisation there are two further requirements. First, where the country is very varied in soil and climate as in the case of Nigeria, and where agriculture is to be based on direct native production, a whole network of model and experimental farms is essential . . . Secondly, there should be a section of the Agricultural Department devoted to maintaining contact between the research workers and the native producer."

Approval is given of the suggestion for the publication of "a quarterly agricultural review the articles in which would be of such a character that they could be readily followed by officers of the administrative and other departments; and by educated Africans . . . Veterinary work should, . . . be included, as well as items of interest to British West Africa, regarding for example, what is being done in French West Africa, and by the Imperial College of Tropical Agriculture at Trinidad."

G. W.

(*To be continued.*)

Grants by the Royal Colonial Institute for the Publication of Monographs embodying the Results of Research Relating to the Empire: The Council of the Royal Colonial Institute have resolved to set aside a small sum annually from the funds of the Institute to facilitate the publication of original Monographs embodying the results of research relating to the British Empire oversea. Grants will be made from this fund from time to time upon the recommendation of a small committee. The conditions governing the award of grants can be obtained on application to the Secretary, Royal Colonial Institute, Northumberland Avenue, W.C.2.—(*Journal of the Royal Society of Arts*, Vol. LXXV, p. 226.)

OBITUARY.

The College has been thrown into a state of gloom by the sad loss through drowning of Mr. O. L. Thomas, one of the post-graduate students. The accident occurred on the Manzanilla Beach on the east coast of Trinidad on Saturday, 12th February, at about midday. The currents on this part of the coast are strong and treacherous especially at certain states of the tide and wind. Mr. Thomas who was an indifferent swimmer apparently got out of his depth and was swept away by an undertow and disappeared before the fellow students, who were bathing with him, could reach him. In spite of every endeavour his body has not been recovered.

The late student who was twenty-three years of age had had a promising academic career. He was educated at the Llandovery County School and at University College, South Wales where he graduated as a B.Sc., in Botany and Chemistry. He was then awarded a Colonial Office Scholarship of two years duration. The first year was spent at The Imperial College of Science and Technology, London, and at Cambridge, and he came to the Imperial College of Tropical Agriculture, Trinidad at the end of September, 1926. During the few months he was at Trinidad he made himself well liked socially and was respected for his sterling qualities.

He was specialising in mycology and showed ample promise of developing into a more than useful recruit to the research workers in that particular branch of science. Had he lived Mr. Thomas would have probably joined the Colonial Agricultural Department in Africa, where his brilliance and training would undoubtedly have led to fruitful results.

The College showed their sense of loss and their respect for their late colleague by the way that so many turned out to try and save the body, and a memorial stone subscribed for by all members of the College will be erected in the College cemetery. A memorial service held in Holy Trinity Cathedral, Port-of Spain, on Wednesday, 23rd February, 1927, was very largely attended, and an impressive address was delivered by Archbishop Parry.

* * *

Professor Charles Cleveland Nutting, of the University of Iowa, will be remembered by many in the West Indies as the leader of the Scientific Expedition sent out by the Iowa University in 1918. The expedition worked in Barbados and Antigua.

Professor Nutting was at the head of the Zoological Department of the Iowa University from 1890 to 1926, and was the oldest member of the University faculty in point of service.

In Professor Nutting's death, science has lost a distinguished worker who combined with his scientific ability the qualities of administration and leadership.

TROPICAL WORLD NOTES.

Gold Coast.

General and Administrative :—The term "Gold Coast" (area 91,690 square miles, native population 2,300,000), covers the Gold Coast Colony, Ashanti, and the Northern Territories Protectorate, three distinct areas for administration, but not divided by any marked physical boundary. Ashanti and the Northern Territories are under the control of Chief Commissioners; in the Colony, the 52 divisions are each under a Head Chief who is styled Omanhene, Mantse, Fia or Konor according to race. The policy of the Government is to rule through the tribal organisations, but in many cases authority is weakening as is seen by the increase in distoolments. Consequently policy must be "directed towards strengthening and supporting the authority of the Chiefs and their Councils."

Agriculture :—Cocoa is the chief crop (80 per cent. of the exports) and "there is not room for any startling development of new economic crops. With transport, however, development can be expected in the Northern Territories. With cocoa, a plant sanitation campaign was undertaken in 1925, but there still remains the problem of soil regeneration. The success of cocoa has caused a decline in oil-palm exports in the last forty years from £1,000,000 to a tenth of that sum, but there has been a revival recently. Attention paid to cotton, chiefly in Togoland has had satisfactory results (1922-3, 7,700 lb. seed cotton; 1924-5, 450,000 lb.). To utilise the unproductive area between the sea and the forest belt a Government sisal plantation was commenced in 1920, with a factory near Accra. Results have shown the possibility of the industry, but "further development must be with private enterprise." "It is doubtful whether it can ever succeed as a native peasant industry."

Minerals :—Gold is widely diffused, and the average annual value exported for the last few years is over £875,000. In the Western Provinces the output of manganese is increasing (1916, 4,000 tons; 1925, 340,000 tons). The bauxite at Mount Ejuanema awaits development. The value of exported diamonds from the Eastern Province has increased from £365 (1920) to £184,000 (1925).

Forestry :—Deforestation has become a serious problem, and there has been great difficulty in persuading chiefs to set aside reserves.

Labour :—The mines are the principal enterprises requiring wage-labour. Formerly there was a good deal of uneasiness about the management and care of the labour, but conditions have immensely improved in the last year or so. On the European cocoa, rubber, oil-palm and coconut concessions, pay averages 1*s.* 6*d.* to 2*s.* per day with a total working week of 51 hours. Circumstances are such that when a railway is constructed in the Northern Territories, recourse will have to be had to compulsory labour. (*Cmd.* 2744.)

Nigeria.

Nigeria is three times the size of the United Kingdom and about one-third that of British India, and includes country ranging from mangrove swamps and dense forest to desert. The native population is nineteen millions and about five hundred languages are spoken. Governmental systems range from village communities of pagan tribes to highly organised states of the Emirates. As regards communications Nigeria is well served by waterways, whilst the railways establish communication with the interior, and motor roads connect up the leading towns.

Administration :—In the north "the policy has been to support native rule rather than to impose a form of British rule with the support of native chiefs" and "one of the corner-stones of this policy has been the continuance of the administration of justice by the native courts."

Agriculture :—Cotton is fast becoming one of the chief exports of Nigeria (1903-5, 217 bales; 1925-6, 36,000 bales). The progress of the ground-nut industry is more remarkable (1910, 995 tons; 1925, 127,000 tons) and is almost entirely due to the railway. Cocoa production is increasing (1913, 3,600 tons; 1925, 45,000 tons), and Nigeria is regarded as a potent competitor of the Gold Coast. The Shea nut is a product with a future. Cattle are important in the northern provinces, being reared mainly for the hides and skins. Sheep and goats, horses, donkeys, and camels are kept in those parts of the country free from the tsetse fly.

Minerals :—Alluvial tin is found on the Bauchi Plateau in the Northern Provinces; the production is increasing (1924, 9,000 tons; 1925, 9,293 tons), and development should be greatly increased by railway extension. Coal was discovered in 1909, and present supplies meet with ease all local demands. There are extensive deposits of galena in the Muri Province, and at Abakaliki.

Forestry :—A large area is covered with dense tropical forest and the Forest Department is preserving a sufficient area to maintain head-waters and prevent denudation.

Finance :—The current financial position is thoroughly sound (1925-6; Expenditure £6,583,167, Revenue £8,268,928.)—The surplus balances amounted to nearly £6,000,000 on 31st March, 1926, after allowing for sums advanced to loan works. Being dependent largely on agriculture, the prospect of fluctuations in prosperity should be met by the provision of ample reserves.

Labour :—There are only three industries carried on by private enterprise in which a labour force is required. Twenty-two thousand native labourers are employed by the tin companies and the minimum wage is 4*s.* per week of six working days of eight hours. On the Cameroon plantations, 12,000 natives are employed, the lowest wage being 5*d.* a day. The timber concessionnaires employ native contractors, and the labourers undertake to work for six months before their

accumulated total of daily wages is received. Meanwhile the labourer is given advances to buy food in the local market. The supply of voluntary labour for road and railway construction has always proved inadequate, and recourse is had to compulsory labour. This is recruited by the native authorities and called upon to work usually, and never more than, one month at a time at a rate of about 9*d*. per day.—(*Cmd* 2744.)

* * *

Gambia.

Gambia (area 4,440 square miles; population native 200,000; non-native, 200), is the oldest British Dependency in Tropical Africa, and is composed of the Colony (70 square miles) and the Protectorate (4,370 square miles), this latter consisting of a strip six miles in extent on either side of the River Gambia. For administration the Colony is divided into five provinces each under the control of a Travelling Commissioner. The population consists of several races, clean, hard-working people and honest traders. The whole trade of the Gambia is centred on one crop, ground-nuts, the normal export being about 60,000 tons. Only one-third is actually grown in Gambia. All the river trade is handled at Bathurst and improvements are being made in the harbour and the facilities when the river is in flood a large part of the town is under water. The Government has commenced a reclamation scheme for abandoning part of the town and reclaiming and building up another part.

Agriculture:—The ground-nut crop is most important, and although there are locally grown food-stuffs, the natives prefer to grow ground-nuts and be dependent upon imported foods for their sustenance. The Agricultural Department, instituted in 1924, has taken the following steps to improve and protect the ground-nut crop. Various types have been selected, a campaign arranged for the education of native farmers, and rotary screens have been introduced for cleaning the produce to ensure that the produce shipped is clean.

On account of the last the former discount of 30*s*. per ton for sand has been reduced to 2*s*. 6*d*. per ton. In addition, an improvement in quality is shewn both in the weight of the individual nut as well as in the reduced free fatty acid contents. Cattle are kept in Gambia for show, for dowry, for milk, and for manure—the manurial value of cattle is thoroughly understood by the native farmers. There are no timber forests in the territory, but there is a certain amount of scattered timber.

Finance:—The staple item of revenue is that derived from the export duty on ground-nuts—£1 per ton—and although the financial system cannot be said to be unsound, it seems advisable, in view of the Colony's dependence on a single crop, not to let the surplus balances fall below £70,000 or roughly one-third of the revenue.—(*Cmd*. 2744.)

Sierra Leone.

Sierra Leone (area 27,250 square miles, population, Colony 85,163, Protectorate 1,456,145) is third in size of the West African Dependencies and a little less than Ireland. There is a sharp division between the Colony and the Protectorate. The Colony is the seat of the famous settlements of freed slaves which began in the last years of the 18th century, and supplies large numbers of clerks, overseers, lawyers, and porters to the other colonies. The Protectorate is peopled with Africans in a primitive state of civilisation. Communications are not good. There is a main railway, but further branches cannot be usefully constructed. Roads are few and far between and not long enough to justify motor traffic.

Agriculture.—Agricultural problems are by no means easy, the soil is extremely light and the rainfall very high (nowhere less than 100"). Oil-palm and rice are the most important products, the latter is almost entirely consumed locally. In 1924 palm exports accounted for £1,190,000 out of a total export of £1,510,000. The indigenous oil-palms have a poor yield of both pericarp and kernel oil, and there is a great necessity to introduce and cultivate improved varieties of palm. Great harm is also done to the oil-palms by the annual burning of bush and grass by the native farmers. The other principal crops which are being, or can be, produced in Sierra Leone are ginger, piassava, kola-nuts, coconuts, cocoa, and grape fruit. Sierra Leone is the principal producer of dry ginger for the United Kingdom markets, its quality is not high—whilst West Indian ginger brought £7 7*s*. in 1924, the Sierra Leone product brought only £3 11*s*. A recent price fall has seriously affected the kola industry. Both limes and grape fruit seem to do well, and if any fruit trade is to be developed it would seem that the grape fruit holds out the best chance of success.

Finance:—Sierra Leone is not a rich country. Financial stringency in the past has at times been acute, but a succession of more prosperous years recently has allowed the accumulation of a satisfactory surplus balance.—(*Cmd*. 2744.)

Mr. Harold Cox, the well-known writer on economic subjects, who recently visited Trinidad on his way to Jamaica wrote in an article published in *The Sunday Times* of 30th January:

"Among the many features of interest in the Colony, perhaps the most important to the outer world is the Imperial College of Tropical Agriculture. This is quite a modern development. It was established in 1921, largely as the result of action taken by the late Lord Milner. Its purpose is to provide a centre where students from all parts of the Empire can make a scientific study of the problems of tropical agriculture. The college has already made an excellent start. It is well equipped with buildings, and has a staff of specialists in the different subjects that have to be studied and taught.

INSECT CONTROL IN HAWAII.

(*Continued.*)

The Sugar-Cane Borer.

The sugar-cane borer, *Rhabocnemis obsura* (Boisd.), was the next pest which received attention and it had been known to damage cane in the Islands as early as 1865. The initiation of a project for the control of this beetle was in 1906 when F. Muir journeyed to the Orient, mainly for purposes of investigating other sugar-cane insects. While in that part of the world he also made a search for the cane borer in Southern China, the Malay States and Java but without success, although some material of possibly useful predators was forwarded to Honolulu. Muir then decided to proceed to West Borneo where there appeared to be good chances of meeting with the insect. Unfortunately the result was negative and from there he proceeded to Amboina and afterwards on to Larat by way of Kei and the Aru Islands. The beetle was ultimately found in great numbers in Larat breeding in pinang and sago palms. With the experience and fresh information thus obtained Muir returned to Amboina and discovered that the insect existed there in sago palms and was attacked by a Tachinid parasite *Ceromasia sphenophori* Vil. The first stage in the work was thus attained and there then began the experiment of transporting the parasite from Amboina to Honolulu. Owing to paucity of communications it was necessary to transmit the material *via* Hong Kong and Japan. F. W. Terry was, therefore, sent from Honolulu to Hong Kong to receive the material from Amboina and to attempt the breeding of the fly there. Owing to delays on the voyage, the insects perished before reaching Hong Kong and it eventually became necessary to discover some other locality where the parasites existed from whence it would be easier to forward them to Honolulu. After visiting Ceram, Muir proceeded to New Guinea where both the beetle and its parasite were discovered. With a number of cages stocked with borer larvae, in which the parasite had deposited its eggs, Muir set out for Honolulu *via* Brisbane. On arriving at the latter port he unfortunately had to go to hospital with typhoid. This entailed the sending forward of the cages to Honolulu unattended and all the parasites succumbed before reaching their destination. On recovering from sickness, Muir returned to Honolulu in order to spend sometime recuperating in the mountains and, in January, 1910, he again set out for New Guinea *via* Brisbane. Owing to the shortness of the life-cycle of the Tachinid, and difficulties attending the breeding of the insect in small cages, it was decided to establish intermediate breeding stations in Australia and in Fiji. At Brisbane Muir arranged to meet J. C. Kershaw and provide for the erection of suitable breeding cages at Mossman. This work being accomplished, he journeyed to New Guinea and made ready a large consignment of parasitised borer larvae, together with puparia of the Tachinid, to be taken personally to Mossman. There were serious delays owing to weather, and other causes, before the destination was reached and valuable material was lost as the result. Sufficient parasites were bred out, however, at Mossman for Muir to take to Fiji where he had previously arranged for the erection of a suitable cage for their reception. Muir had left New Guinea with an attack of malaria which continued while he was at Mossman and he ultimately had to go into hospital in Fiji, but not before he had transferred the Tachinids into their breeding quarters. Kershaw arrived in Fiji later, bringing with him a further stock of parasites bred in Mossman, and the final result was that Muir, and subsequently Kershaw, succeeded in conveying the parasites bred in Fiji to Honolulu. It was in the summer of 1910 that the second stage of the work was accomplished, but it was only after surmounting great difficulties. It now remained to establish the Tachinid in the Hawaiian Islands and ensure its distribution in all the borer infested plantations.

A certain number of the flies were directly liberated in the cane fields, as they appeared in the breeding cages, while others were retained for building up an increased stock of the insect. In order to breed the parasites successfully it was necessary to have large cages in the open air. The host larvae were inserted in artificially-made holes in sugar-cane stems, one to each internode, the holes being stopped with frass from the larval burrows. The larvae were either gathered direct from the fields, or bred in large tubs, in which many lengths of soft cane were placed along with the beetles. When the appropriate conditions were attained, from 50-75 Tachinids were introduced into a cage. These freely parasitised the borer larvae and, when the Tachinids attained the pupal condition, their puparia were placed in suitable types of receptacles out in the plantations where the flies were due to emerge. It is remarkable that such small numbers as 100-250 puparia often proved sufficient to colonise average-sized plantations. In one instance recoveries were made nine months after liberation of the Tachinids. The latter were readily found and had spread from $\frac{1}{2}$ to $1\frac{1}{2}$ miles in the adjoining fields, having passed in the meantime through five or six generations. By the end of 1913 the beneficial insect had become firmly established in 39 different plantations and, in that year, there was a noticeable reduction not only of the borers in the fields, but also in loss of the crop harvested. In one plantation the number (in ounces) of beetles collected fell in two years from 27,010 to 1,568. There appears to be no doubt that, at the present day, the Tachinids have attained their maximum efficiency. Owing to the great reduction in the number of borers present there is a corresponding scarcity of parasites. In many localities indications of borer injury are hard to discover and the parasites correspondingly difficult to find, but they are

nevertheless present. At times local outbreaks occur and, in certain districts, heavy rainfall and high winds, coupled with a variety of cane that lodges, the effectiveness of the Tachinid is much less than elsewhere and the borer gains the ascendancy. Efforts to secure other parasites from Mexico in 1923 were not successful and attention is now being given to the East Indies in the search for further beneficial insects.

(To be Continued.)

COTTON-JASSID IN SOUTH AFRICA.

J. L. MOERDYK, Dip. Agric., B.Sc. (Agric.)

(Concluded.)

ON looking at the effect of jassid on the cotton plant we notice that the young leaves are apparently healthy, and have no nymphs on them. Nymphal migration from leaf to leaf is not the rule, hence only the older leaves, on which the eggs have hatched, are badly affected. The edges of the affected leaves turn yellow, the discolouration very often being definitely demarked along the vein. The edges of the leaf begin to draw downwards and the leaf becomes crinkly. The discolouration proceeds inwards and becomes brownish or red.

On close observation there appears to be a destruction of the chlorophyl granules, causing the leaf to become opaque. In the early stages the discolouration appears only in the cells round the stomata ; later, all cells appear red, both in the ordinary leaf cells and in the vascular tissue.

There are several possible explanations of this upsetting of the equilibrium in the leaf :—

1. Direct loss of cell-sap due to the sucking by the insect.
2. The introduction of bacteria, fungi or a virus which accumulate in the tissue.
3. The introduction of a toxin.

There is insufficient evidence to accept any one particular explanation, but experimental evidence seems to indicate that the last mentioned is the most probable.

In connection with point 1, we find that large nymphs do more damage than smaller ones, and a large number of jassids do more harm than a few. On the other hand one or two nymphs on a leaf may show a decided effect. The fact that in a year of good rainfall jassid effect may be as bad as during a drought also argues against this possibility.

As regards the possibility of bacteria, fungi or a virus being responsible for the deterioration, several experiments were carried out. In plants partly free from jassid the free portion remained healthy, whereas the infected part died. Evidently no disease organisms were carried from one part of the plant to the other. Where jassids were confined to a definite part of a leaf, that part alone suffered. On fumigation all, except very badly damaged leaves recovered within a few days.

When cultures were made from surface sterilised leaves a bacterial organism was isolated and out of a number of inoculations of this pure culture one case actually showed a slightly yellowish discolouration. This was not typical however and soon disappeared. None of the other inoculations showed any effect whatsoever. It seems likely that the organism was secondary, but this should be conclusively demonstrated before anything definite can be said.

Workers on closely allied diseases —Hopperburn of Potatoes and other forms of insect-caused blights—put down the active principle as a toxin injected with the saliva of the insect. This theory fits in best with the observed facts in this instance.

As mentioned earlier in this article a distinct difference in the resistance of the plants in a cotton field is noticed—a fact made use of in overcoming the passid problem. This resistance is definitely hereditary and hence a strain or strains of cotton can be produced on which the jassid has little or no effect. Several such strains have been isolated at the breeding station at Barberton, Transvaal, by Mr. Parnell, the Empire Cotton Growing Corporation plant breeder.

A very close correlation was found between resistance to jassid and hairiness of the plant. So marked is this correlation that the latter can be used as a fairly safe indicator of a plants' powers of resistance even before jassid makes its appearance. What the actual effect of this hairiness is, has not been made out. It may be purely mechanical, hindering the movements of the active young nymphs, or it may be that it indicates a cell-sap of unsuitable pH value for the successful hatching of the jassid eggs.

Not only do the plants differ in their suitability as host, but they also differ in the tolerance which they exhibit towards the insect, some plants being able to tolerate a large number of jassids without showing very much effect, others being badly damaged by a slight infestation. Varieties like *Cambodia*, which are naturally immune, have proved to have a high resistance to infestation and a high degree of tolerance when infested.

In conclusion a few words should be said about the jassid itself. The cotton-jassid belongs to the *Jassidae* and is classed as *Empoasca* (*Chlorita*) *fasciales*. It is green in colour, about $\frac{3}{16}$ inch long and feeds on a large number of host plants. Both the nymphs and the adults feed. The female lays its eggs in the soft part of the stem, petiole and thick veins of the leaf. The egg is sickle-shaped and about $\frac{1}{16}$ inch long. The incubation period varies with the season, probably from 8 days to a month in cooler weather. The nymphs emerge during the night or early morning, but not in direct hot sunlight. When hatched the nymph is transparent but becomes green after a day or two. It moults 3 or 4 times before becoming an adult. At Barberton the entire life-cycle, in warm weather, occupies about one month.

TOBACCO CULTIVATION.

PROFESSOR J. SYDNEY DASH, B.S.A.

(*Concluded.*)

Preparation, Planting and Cultivation.

Land for tobacco should be first thoroughly ploughed and any green growth efficiently incorporated; a second ploughing is given a little time after the first, in the opposite direction, when an application of well-rotted pen manure at the rate of about 10 tons per acre can be worked in; then at the time of planting the surface should be harrowed and brought to a fine tilth. Drains may be dug at this time. The practice next adopted at the College is to open shallow furrows 3 feet apart—the distance between the rows—into which a mixture of well-pulverised cattle droppings and wood ashes is applied at the rate of about 5 tons per acre. The soil is then thrown back on this and the plants inserted, a cloudy day being usually selected for the latter operation. Care must be taken in removing the transplants from the nursery beds which, if dry, should be thoroughly watered before any plants are removed. The distance between the plants in the rows depends on the type of tobacco grown; under average conditions 2 feet is ample. After the plants have begun to grow two or more surface cultivations according to the nature of the soil should be given; cultivation should cease when the plants have reached such a size as to render them liable to damage by implements and labourers, usually at the topping stage.

After treatment.

When the plants are about a foot high they may be gone over and one or two small leaves at the bottom which would be of little value removed. As soon as the plants have reached the flowering stage the operation known as "topping" is carried out and consists in the removal of the terminal bud to prevent seed development. At this time those plants selected for seed are marked and the flower heads allowed to develop. Topping should never be neglected if leaves of the required texture are to be obtained. The number of leaves left per plant will depend on the class of tobacco grown; generally speaking, the lighter sorts are topped high—12 to 16 leaves, and the heavier classes low, about 8 to 10 leaves. After the plants have been topped suckers will shortly appear in the axils of the leaves and these should be regularly removed. The leaves will now rapidly take on size and body until ready for harvest which is usually 4 to 6 weeks after topping.

Pests and Diseases.

The tobacco plant is subject to a number of troubles, but only a few of those commonly met with here need be referred to. The most important pest up to the present has been the mole cricket; it cuts off young transplants and losses may be as high as 50 per cent. of the stand, especially where tobacco is grown near grassy areas from which the crickets migrate. It has been noticed that fresh grass clippings placed underneath the young plants when put out in the field gives them a certain amount of protection. Where a plant is cut or injured it is advisable for a search to be made in the soil and the insect destroyed before another plant is inserted. Fields have to be frequently supplied where the mole cricket is prevalent. The horn worm and the bud worm make their appearance at an early time and the plants have to be regularly searched for the caterpillars which should be destroyed. This operation must be efficiently performed during the entire growing period in order to avoid serious losses from defoliation. The suppression of all waste vegetation near tobacco fields and seed beds will often aid in preventing liability to serious caterpillar outbreaks. Dusting or spraying is sometimes recommended against caterpillars where the area is large, but there is danger of leaf damage from the poisons used. This is a problem for future investigation under local conditions. Grasshoppers may also be mentioned as capable of doing considerable damage where their numbers are large.

In the case of diseases, reference has already been made to "damping off" in the seed beds; too much shading and humidity helps to spread the disease, likewise thick seeding; in some cases entire beds may be lost from this trouble. Liming is beneficial, but a change in site is advised, also proper sterilization of the soil as previously noted. So far, at the College, there have been no instances in the field of other well-known tobacco diseases such as root-rot, wilts, or mosaic. Some leaf spotting has appeared due to the recent excessive rainy conditions, coupled with the severe setback which the maliciously pulled out plants received.

A careful watch is being kept for any new troubles which may appear with increase in area.

Harvesting.

The stage at which tobacco is harvested plays an important part in successful curing; it requires a little experience to judge when the crop is at the right stage for reaping. The leaves should neither be too ripe nor too green and the principal indication of ripeness is the decided change of colour. As maturity approaches there is a gradual change from a deep green to a greenish yellow and where the leaf is of heavy texture the yellow may only show in spots. The leaf itself at this stage instead of being soft and pliable becomes rough to the touch and brittle. In general, tobacco which is air-cured should not be allowed to get over-ripe.

There are two methods of harvesting tobacco: the whole plant and single leaf; each has its advantages. The former is the more economical but its disadvantage is that all the leaves are not in the same stage of ripeness. The single leaf system requires more labour; on the other hand, by this means it is possible to get all the leaves in the same stage of ripeness—an important factor in the production of highest quality tobacco. Nevertheless, the whole-plant method is widely used in the case of manufacturing tobacco and has proved quite satisfactory at the College where

the practice is adopted of splitting the central stalk of the plant with a sharp knife to within 6 inches of the bottom, the stems being next severed just above the ground. The splitting of the stalk assists in the drying out of the tissue. The plants are allowed to wilt for a short time and removed to the curing room where they are suspended over wires or laths, great care being taken to avoid bruising or breaking of the leaf.

Tobacco should be harvested in fine weather, but not while the dew is on it or immediately after rain. Preferably, reaping should not be done much before 3 o'clock in the afternoon, unless the plants are allowed to wilt under shade.

Curing, Stripping and Sorting.

Certain chemical changes take place during the curing for which processes the prime requisite is proper ventilation to ensure a good circulation of air. Overcrowding of the plants in the curing shed should be avoided; on the other hand, exposure to strong winds may do considerable damage to the leaf, while too much damp, moist air may cause harm by setting up attacks of mildew.

The size of shed will naturally depend on the area under the crop; generally speaking, about one square foot of floor space for every 3-4 plants, for each story or tier in shed. Any vacant out-building can often be converted into an improvised curing shed if precaution in respect to proper air circulation be taken. An inexpensive building with thatched roof will equally serve the purpose.

The plants are allowed to hang until the mid-ribs of the leaves are thoroughly dry before being taken down—usually after 30 or 40 days. Curing completed, humid days have to be selected for the operations of stripping and sorting of the leaves, as on no account should tobacco be handled if the leaves are dry and brittle.

Sorting consists in classifying the leaves as fast as they are stripped into two or three grades depending on requirements. In this operation, the bottom leaves are usually kept separate from the rest, while the latter may be further classified into "middles" and "tops." The tobacco is then pressed and packed in cases for delivery to the factory.

The process known as fermentation is beyond the scope of this paper.

Yields and Prospects.

Yields vary, depending on soil and treatment and the type of tobacco grown. Ordinarily, lower yields may be expected from varieties producing bright leaf than from heavy tobaccos. At the College last season from half-an-acre, of which a large part was in heavy tobacco, a yield of 700 lb. was obtained and realized $504.00. In addition, there was a small ratoon crop of 200 lb. which fetched much lower prices. This yield which works out at the rate of 1,400 lb. per acre (exclusive of ratoon) may be considered good but certainly not excessive. On the average, it required 3 to 4 plants to produce 1 lb. of cured tobacco; at 6 square feet to each plant, if the field stand had been complete, the yield on the area in question would have approximated 1,800 lb. per acre. The losses were due almost entirely to mole cricket which is likely to be an outstanding cause of poor stands under local conditions. From these figures, it is considered quite possible for any grower to get 1,000 lb. of cured leaf per acre which, at fair prices, will return a satisfactory profit.

Tobacco has not generally been a very successful crop where individual areas are large; the amount of supervision and handling necessary has usually restricted the area to be grown by any one individual—in the United States and Canada about 5 to 10 acres. The work, however, is not arduous even in the tropics, but time is an important factor. Preparation completed, keen gardeners in the early mornings and late afternoons will find pleasant occupation in the ordinary routine operations associated with the crop. Much can be done by mutual help in communities, notably at harvest time. In such ways, the actual amount paid out for labour can be greatly reduced with substantial profits accruing to the grower.

It should be emphasized, however, that any attempt at tobacco growing, to be in every way successful, must be seriously made, for the crop is a precarious one and left to its own resources is doomed to failure. Uniformity in quality and dependability of supply are commercial considerations of the highest importance and should be the constant aim of every tobacco grower if the well-being of the industry is to be maintained.

BOOKS RECEIVED.

We have to acknowledge the receipt of the following books:—

Soil Conditions and Plant Growth. E. J. Russell, pp. 516, 20 plates. Longmans, Green & Co., London, price 18*s*.

Investigations on Oil Palms. Dr. A. A. I. Rutgers, pp. 156, 17 plates. Experiment Station of the A.V.R.O.S. Medan.

The Rural Industries of England and Wales. H. E. FitzRandolph and M. Doriel Ray, pp. 160, 9 plates. Claredon Press, Oxford, price 5*s*.

Elements of Mathematics. Jones and Daniels, pp. 240 Liverpool University Press, price 8*s*. 6*d*.

The Production of Cotton. Collings, pp. 256, 90 plates. John Wiley & Son, per Chapman & Hall, London, price 17*s*. 6*d*.

The Commerce of Agriculture. F. A. Beuchel, pp. 440 100 figs, John Wiley & Son, per Chapman & Hall, London, price 18*s*. 6*d*.

Co-operation and Competition in the Marketing of Maize in South Africa. H. Frankel, pp. 144. P. S. King, London, price 8*s*. 6*d*.

Wheat Breeding Investigations. Biffen and Engledow pp. 114, 30 plates. Ministry of Agriculture and Fisheries.

Cultivation of Citrus Fruits. Hume, pp. 562, 237 plates. Macmillan & Co., price 21*s*.

An Outline of Plant Geography. Campbell, pp. 392, 52 plates, Macmillan & Co., price 17*s*.

The Dominion and Colonial Offices. Fiddes, pp. 288. Putnam, London, price 7*s*. 6*d*.

British Slavery and Its Abolition. Mathieson, pp. 318. Longmans, Green & Co., London, price 16*s*.

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Progress of Sugar Industry in Queensland.

The annual report of the Bureau of Sugar Experiment Stations of Queensland issued on 1st December, 1926, contains interesting figures showing the progress made by the Industry during the past twenty-seven years. The cane area in Australia utilized for grinding has increased from 79,435 acres in 1899 to 189,466 acres in 1925 and 201,506 acres in 1926. The yields are given as follows :—

Period.	*Tons Cane per Acre.*	*Tons Sugar per Acre.*	*Tons Cane per Ton Sugar.*
1899-1908	14.76	1.60	9.20
1909-1919	17.37	1.99	8.68
1919-1925	16.69	2.15	7.76

A steady improvement is to be noted in the yield of sugar per acre which is credited to improve efficiency of the factories, the work of the Cane prices board and the efficient and close co-operation and investigation of the Bureau of Sugar Experiment Stations.

* * *

Polarisation of Raw Sugars imported into United States.

The 19th annual review of the New York Sugar Trade Laboratory states that 21,774 samples of sugar representing an average of 1,680 bags each were tested during 1926. The average polarization of all samples was 96.11°.

The percentage of the samples testing between 96° and 97° was 59.25; those testing between 95° and 96° represented 25.33% of the total; and the percentage of samples testing below 95° was 7.32. The polarisation of samples of sugar from Cuba averaged 96.04°, from Porto Rico 96.39°, and from the Philippines 96.79°. Those obtained from other countries averaged 95.86°.—(*Planter and Sugar Manufacturer*, 5th Feb., 1927.)

* * *

Alcohol from Molasses.

The Sugar Industry of Mauritius has become interested in the possibilities of manufacturing from cane molasses high grade industrial alcohol which could be used to replace fuel oils, gasolene and kerosene. It is estimated that a litre of 95 per cent. alcohol could be produced at a cost of about $0.069 from molasses which can normally be delivered at the distillery at a cost of about $0.69 per 100 litres. Based upon minimum annual production in Mauritius of 200,000 metric tons of sugar, normally giving about 60,000 tons of molasses, a possible production of from 500,000 to 800,000 gallons of alcohol is envisaged.—(*Facts About Sugar*, 27th November, 1926.)

Cane Diseases in Queensland.

The United Cane Growers Association has discussed the question of cane diseases, and it has been suggested that the Sugar Bureau should be asked to co-operate to a greater extent with growers in the control of plant selection, particularly in those districts where diseases are known to exist. The report says that the Mosaic disease which is spreading rapidly under favourable conditions, requires close watching. A decision that is interesting was one that the Council should take steps to get the Cane Prices Act so amended as to prevent cane being replanted in the same year on land from which cane has been harvested.—(*The Planter and Sugar Manufacturer*, 22nd January, 1927.)

* * *

Green Manuring in Formosa.

The practice of green manuring is used to a considerable extent in Formosa, according to S. G. Ruegg. On the plan followed, it is estimated that 31 lb. of nitrogen per acre is added to the soil. A green clover crop is grown every three years. Cane trash was burned at one time; but this is now ploughed under. The Formosan soils have had a tendency to produce poor root systems. Good roots are very important in cane; and the more organic matter the soil gets, the looser and more friable it becomes. The Formosan leaders feel that they are working in the right direction in this matter; and expect good returns in years to come.—(*The Planter and Sugar Manufacturer*, 15th January, 1927.)

* * *

Colloids and Cane Juice Defecation.

In their summary of an investigation into the action of bone-char on colloidal substances in melt liquors, H. S. Paine and M. S. Badollet, of the U. S. Carbohydrate Laboratory, express themselves as follows: "It is important to keep in mind that defecation of cane-juice in raw-sugar production eliminates primarily irreversible colloids and only a portion of these. It eliminates practically no reversible colloids. In order to remove the latter, a substance of high absorptive capacity, such as carbon, is required. Since bone-char shows such preferential affinity for absorbing and retaining the irreversible colloids, thus tending to exhaust the char and reduce its absorbing action toward the more difficult removeable reversible colloids, it is all the more important that the irreversible colloids be eliminated as thoroughly as possible during defecation and clarification in raw sugar manufacture. Viewing the production and refining of raw cane-sugar as an economic unit, it is cheaper to remove irreversible colloids during the defecation and clarification of the cane-juice than to use an expensive material such as carbon for accomplishing this purpose."—(*Facts About Sugar*, 15th January, 1927.)

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Fertilizer Imports into Great Britain.

According to information obtained by the Ministry of Agriculture in London, 151 tons of ammonium sulphate, valued at £2,023, were imported into Great Britain and Northern Ireland during 1925. During the same period, 5,077 tons of calcium nitrate, value £58,026; 57 tons of calcium cyanamide, value £509, and 81,324 tons of sodium nitrate, value £1,020,854, were imported. The production of ammonium sulphate in Great Britain in 1925 was 388,000 tons. These figures show that the demand for sodium nitrate is still very great, the amount imported nearly equalling the total amount of all other nitrogenous fertilizer salts imported or manufactured.

* * *

Measurement of Nitrogen-fixation in Soil.

M. Winogradsky, who, since the Russian revolution has worked at the Pasteur Institute in Paris, has recently described a method for measuring the capacity of a soil for the fixation of atmospheric nitrogen. A soil is believed to be active when the addition of carbohydrate brings about rapid growth of *Azotobacter*. On the other hand, an inactive soil to which carbohydrate has been added, develops no *Azotobacter* growth. A small amount of the soil is spread on silica gel containing mannite. The culture is then incubated for 48 hours at 30°C. *Azotobacter* colonies arise, and their number may be counted.

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Surface tension measurements for determining the effect of Decolorising Carbons on Sugar Juices.

The measurement of surface tension in sugar-factory liquors, as a means of tracing the effects of various treatments, has recently been frequently urged. Tensometers, such as Du Noüy's instrument, have given reliable data. Dr. F. Tödt (*Zeit. Ver. deuts. Zucker-Ind.*, 1926, p. 253, *see J. Soc. Ch. Indus.*, 6th Aug., 1926, p. 641) prefers Traube's stalagmometer to the Du Noüy apparatus, however, and recommends it especially for practical sugar-factory control. He has employed the stalagmometer in a study of decolorising carbons in sugar refining.

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Textiles from Tropical Grasses.

The problem of converting tropical grasses and other fibrous substances into textiles for apparel and other uses is claimed to have been solved by Dr. Dinshaw Nanji, of Birmingham University. World patent rights have been secured on a chemical process for the separation of fibres preparatory to spinning.—(Copied from *Indus. Engin. Chem.*, News Edition, 10th Aug., 1926, p. 4.)

Analysis of Lime used in Sugar Manufacture.

The determination of calcium oxide in the presence of calcium carbonate may be made by either of two reliable methods. The first consists in adding excess of iodine solution to a well-hydrated portion of the sample, and then titrating with sodium thiosulphate. The second consists in adding excess of zinc chloride solution, and titrating with sodium hydroxide, using as indicator a mixture of phenolphthalein and alizarincyanine-green C. Either method is quicker than the customary sucrose method. The zinc chloride method is the cheaper, and thus the more satisfactory for the sugar industry when many determinations have to be made in routine analysis.—J. C. Belair, *Ind. Engin. Chemi.*

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Potash-Nitrogen Fertilizer from Spent Distillery Wash.

In Italian molasses-distilleries, the spent wash is concentrated and then calcined to recover potassium salts. In order to obviate the complete loss of nitrogen compounds involved in this procedure, the concentrated wash, of 32-36° Brix (density 1.139-1.159) is sometimes treated with kieselgnhr (diatomaceous earth) or with porous silica derived from leucitic rocks. The agents absorb the nitrogenous components, yielding a granular substance which is named Kalinozote. It serves as a useful potash-nitrogen fertilizer.—E. Cerasoli, *Giorn. Chim. Ind. Appl.*, 1926, p. 61. Abstr., *J. Soc. Chem. Ind.*, 9th July, 1926, p. 562.

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Atmospheric Nitrogen versus Chile nitre.

The consumption statistics for 1925 show a 15 per cent. decrease in the use of Chile nitre, and several trading companies, dealing in this fertilizer, have been unable to declare any dividend. The situation, however, is partly due to the general depression in the Nitrogen market caused chiefly by the fall in value of the French and Belgian currencies. At any rate, the former predominant position of Chile nitre, on the European markets at least, now seems to be threatened by the constantly growing production of fertilisers from atmospheric nitrogen.—*Indus. Engin., Chem.* News Edition, 10th July, 1926.

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Chemistry of Sugar Refining by "Norit."

In the *International Sugar Journal*, 1926, p. 302, Dr. P. Honig describes the effect of the treatment of Cuban sugar solutions by "Norit" on certain physical properties, such as surface tension, and on colour, purity, and mineral matter content. Colour and surface tension were chiefly found to be altered, whilst mineral salts were removed to the extent of 20 to 25 per cent. of their original concentration.

The Carnegie Institution has very generously promised £1,000 towards the upkeep of the College Library.

REVIEWS.

ROOT DEVELOPMENT OF FIELD CROPS. By John E. Weaver, Professor of Plant Ecology, University of Nebraska. McGraw-Hill Book Co., New York, 1926.

It appears a fairly safe generalisation that the most valuable text-books are those which incorporate the greatest proportion of their authors' own work. Professor Weaver has done a great deal of work on a somewhat neglected branch of botany, and collected the results into a very useful volume.

The field crops dealt with are chiefly those of Nebraska and neighbouring States, but the principles illustrated are of universal applicability, and the numerous diagrams given are particularly illuminating. One wonders how many, even among botanists, realise that the tap-root of an insignificant grassland weed may be drawing water and nutrient salts from a depth well below ten feet.

The interrelationships of root growth on the one hand and climate, soils, fertilisers, tillage operations and crop rotations on the other, are all considered, as well as the importance of a knowledge of root systems in weed eradication, use of cover crops, intercropping and kindred questions.

The fact that the form of a root system is, like every plant character, the result of interaction of genetic constitution and environmental factors, is recognised throughout. The plant-breeder is, perhaps, particularly liable to neglect root characters, and yet their important rôle in determining crop yield is unquestioned.

Considerations of space and scope prevent the author from dealing extensively with the work of Howard on root development in Indian crops, but this is included in the bibliography of over two hundred references.

The technical production of the book keeps up the high standard of the series of publications in agricultural and botanical sciences to which it belongs.

E. E. C.

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Brown, F. G. W.—HIGHER MATHEMATICS FOR STUDENTS OF ENGINEERING AND SCIENCE. pp. XII, 488, London, Macmillan. 1926.

Usherwood, T. S. and Trimble, C. J. A.—INTERMEDIATE MATHEMATICS (Analysis). pp. XXIV, 457, London, Macmillan.

PRACTICAL MATHEMATICS FOR TECHNICAL STUDENTS. PART I. pp. 370. London, Macmillan.

The unspecialised student reading books on particular branches of mathematics becomes annoyed with the procession of *minutiae*. Consequently, unlimited efforts have been made to bring the main points together in single works. The three works mentioned above do this admirably for technical students. We now await selections of a similar nature which will satisfy the needs of agricultural students who are also interested in economics and statistics.

G. W.

COLLEGE NEWS.

HIS MAJESTY THE KING has graciously consented to become patron of the Imperial College of Tropical Agriculture.

* * *

Visit of Sir Arthur Shipley.

THE Chairman of the Governing Body of the Imperial College of Tropical Agriculture (Sir Arthur Shipley) paid a visit to Trinidad last month. He arrived by the s.s. *Pellerin de la Touche* on 5th February and left by the s.s. *Bayano* for England on 23rd February, and made his headquarters at the College where he was the guest of the Acting Principal and Mrs. Evans. Happily Sir Arthur Shipley was able to stay longer than had been originally planned and was thereby enabled to make a very thorough inspection of the College and all its activities. He expressed the greatest satisfaction at the immense progress that has taken place since the time of his last visit three years ago. At that time the College was inadequately housed in the old building, formerly a Yaws Hospital, that had been handed over as a gift together with the Estate and a grant of £50,000 by the Government of Trinidad and Tobago. The main building, an imposing edifice, has been completed and equipped and is in full use and in addition the old buildings that have been completely remodelled. New residences have been put up for some of the professorial staff, a residential Hostel and a Dining Hall for the students are in course of erection and the grounds have been carefully laid out. Visits of inspection were made to each department and the professors in charge of individual sections were consulted with regard to future development and present needs. The need for more laboratory accommodation is becoming evident and it is intended to proceed with the construction of a new Chemical laboratory and an Agricultural block as soon as possible. This will relieve the congestion in the main building and will permit of more space being allotted to the library.

The necessity for an estate has now become obvious. Tropical plantation crops require a great deal of room compared with the annual crops of temperate zones and progress is already being hampered by lack of space. The suggestion that has recently being made, that the College should undertake a course for the training of Estate Managers and Overseers, has further emphasized this point since it is impossible to give adequate training of the type required without an estate.

The need for an estate, therefore, was a matter that was given a great deal of attention. His personal efforts in the matter of insisting that the College should be provided with a suitable plant for the production of electric light met with the whole-hearted support of all connected with the College.

During his stay, Sir Arthur made a special point of getting into touch with most of the

prominent people in the Colony and was thereby able to form an opinion of the position that the College has already achieved and of some of the problems that lie ahead.

* * *

He paid a visit to the Cotton Research Station of the Empire Cotton Growing Corporation and also visited several sugar and cocoa estates and was struck by the way in which the planters have invariably assisted the College authorities, both in research and in the training of students.

He was invited to attend a meeting of the Froghopper Investigation Committee and expressed the opinion that the lines of work undertaken were both sound, and very well thought out, and held out every prospect of success. His hint about mongoose destruction also commanded attention.

The prolonged visit of the Chairman of the Governing Body has created an excellent impression. The fact that he stayed at the College itself and took pains to find out whether any grievances were being harboured and what difficulties were present was in itself a gesture to the effect that the Governing Body in London takes the greatest possible interest in the affairs of the College in Trinidad and is anxious to help in every possible way. It augurs well for the future.

* * * G. E.

Sir Harold Lyle, since 1913 British Consul General of Bangkok, visited the College on 25th February.

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On 22nd February, the Earl of Radnor visited the College. In 1918 the Earl of Radnor was Director of Agricultural Production, B.E.F.

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Among other visitors have been : Mr. and Mrs. W. Foot Mitchell ; Mr. E. W. T. Tennant ; Mr. J. Stanhope Lovell; Lieut.-Com. R. Morris, R.N. from H.M.S. *Wistaria* ; Mr. C. W. Murray and Mr. J. Gordon Miller.

* * *

We have much pleasure in announcing that the Government of Southern Rhodesia has contributed to the funds of the Imperial College of Tropical Agriculture, through their High Commissioner, the sum of £100.

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The College Sugar Factory started grinding on 15th March, and it is intended to crush 1,200 tons of cane within the next two months. A detailed programme of research and experimental work will be carried on in connection with sugar technology.

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A demonstration in connection with coffee production took place on 9th February, when Messrs. Fitt and Wight of Messrs. Alston Ltd. kindly conducted a large party over their works and the processes of hulling, cleaning and podding coffee were seen.

We are pleased to record the generous gift of £100 from Mr. T. Geddes Grant as a donation towards the Sports Section of the College. In his acknowledgment, the Acting Principal mentioned that the cheque will be used towards the purchase of grass cutting machines and rollers for the upkeep of the cricket and football grounds.

* * *

On 22nd February Mr. Harold T. Pooley, General Secretary of the British Empire Producers' Organization, visited the College accompanied by Mrs. Pooley. Mr. Pooley is making a tour of British Guiana, the West Indian Colonies and Canada, in order to confer with the Association of Producers affiliated in the organization and to study the economic problems with which they are confronted.

* * *

The Rt. Hon. Viscount Ullswater, G.C.B., P.C., and Viscountess Ullswater visited the College on 7th March. His Excellency the Governor brought them to St. Augustine and the party was shown round the College by the Acting Principal. Viscount Ullswater expressed particular interest in the Library and promised to assist in the supply of certain scientific books. Viscount Ullswater was formerly Speaker of the House of Commons.

* * *

On 21st February students under Professor Dash visited the St. Clair Experiment Station. Mr. R. O. Williams, Curator, had arranged an exhibition of citrus fruits and students were asked to give their opinion of the commercial possibilities of eight varieties of grape fruit. Later the party went round the grounds and saw exhibitions of budding and grafting. Our thanks are due to the Agricultural Department and Mr. Williams for arranging this exhibition.

* * *

At the 40th Meeting of the Governing Body held on 14th January, Mr. Charles Frederick Wood, partner in the firm of Goschens and Cunliffe, and Director of Barclays Bank (Dominion, Colonial and Overseas) was co-opted a Governor pursuant to Article 5 of the Royal Charter of Incorporation. Mr. Wood has, from its inception, taken a great interest in the Imperial College of Tropical Agriculture movement and was closely identified with Lord Milner's appeal, which met eventually with such a successful response.

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On Wednesday, 2nd March a party under Professor Shephard visited Waterloo Estate for the purpose of examining the costing system. Captain Watson, the manager, arranged that the party should be shown first the book-keeping system adopted in the Stores department. Later, in his office, he explained the system in detail, calling attention to the difficulties experienced in the establishment of costing systems on sugar estates. The College is deeply grateful to Captain Watson for the interest shown the party and the able way in which the system was expounded.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—After a long sluggish period, a decidedly better feeling prevailed on the sugar markets towards the end of February and the general tone on both sides of the Atlantic ruled very steady. Sooner or later the estimated decrease of more than a million tons in the world's production must make itself felt, but the permanency of any marked improvement will depend on the purchasing capacity of consuming countries. It should be noted that the disturbed conditions in the Far East must have an important effect on a quarter which has been of great help in the distribution of the heavy stocks of sugar recently existent. For the United Kingdom, Board of Trade returns give consumption for January as 114,599 tons, against 122,381 tons in the same month 1926.

Current quotations (12th March) are :—Foreign 96°, 15*s.* 1½*d.* *c.i.f.*, Preferential 18*s.* 9*d.* *c.i.f.* B.W.I. Grocery Crystallised has been rather neglected, low to low medium 28*s.* 1½*d.* to 30*s.* good to fine 32*s.* to 34*s.* per cwt., duty paid.

COCOA.—For the past few months the trend of cocoa prices has been pleasing ; the values of all growths continues to rise and considerable business is transpiring. On 23rd February, Accra fair fermented closed at the highest point for several years ; 68*s.* for afloat, 69*s.* for March-May, 71*s.* for April-June. More spot business was done, and fine Trinidad stood at 87*s.* to 88*s.* landed. Sales of Grenada were made at 80*s.* to 81*s.* for fine, St. Lucia 75*s.* to 79*s.* for fair to very fine and fermented Jamaica at 78*s.* per cwt. On *c.i.f.* terms, Trinidad plantation hardened from 72*s.* 6*d.* to 76*s.* for unnamed marks, 79*s.* being asked for well known brands. On 12th March, Trinidad L.L.T was quoted at 90*s.* to 92*s.* and Grenada L.L.T. at 87*s.* 6*d.* to 90*s.*

COTTON.—Prices have shown no decided tendency and the unusual imports of American cotton to India sustain the market. Trade, however good, cannot consume this season's supply and so if prospects point to another large crop next season, it is hard to see how prices can be sustained under so heavy a weight of cotton. The Liverpool price of Mid-American, 24th February, was 7.84*d.* Sea Island remains in limited demand and prices remain unchanged ; Good, 2*s.* 4*d.*; Fine, 2*s.* 8*d.*; Extra Fine, 2*s.* per lb. (12th March).

RUBBER.—The market has been firm with a slightly advancing tendency. Near delivery demands have been good and there has been a noticeable revival in the interest for forward positions. Rumours, chiefly from abroad, that the Stevenson Restriction Scheme was to be scrapped have been refuted in the House of Commons by Mr. Amery, the Colonial Secretary. On 24th February, spot business was done in Ribbed Smoked Sheet at 1*s.* 7⅜*d* to 1*s.* 7½*d.*

COFFEE.—Poor grade coffee is cheaper and finer grades are no dearer, but between these extremes value appreciates and good prices have been paid at auction sales for all desirable qualities. On 23rd February, Costa Ricas showed a good advance—203*s.* being paid for a choice mark. Kenya was lower but quality was inferior. Santos has been weak and should it go lower, competing varieties will fall in sympathy.

COPRA.—The market has been dispirited. Trinidad (12th March) is quoted at £26 5*s.* *c.i.f.*

LIME JUICE.—There has been rather more enquiry for Raw, at 1*s.* 6*d.* to 1*s.* 9*d.* for pulpy to good clean. No demand for concentrated.

NUTMEGS. — Market quiet and steady. Unassorted Grenada 1*s.* 2*d.* (12th March), wormy and broken, 9*d.* per lb.

MACE.—Steady. Fair, pale and red per lb. 3*s.* 9*d.* (12th March).

SPORTS.

Association Football Club.

Feb. 21st..	Imperial College	..3	(Newman 2, Martin 1).
	H.M.S. *Wistaria*	..3	(home).

Hockey Club.

Feb. 15th..	Imperial College	..4	(Potter 2, Rutter 1, Newman 1).
	Rovers	..4	(away).
Feb. 22nd..	Imperial College	..1	(Potter).
	Wanderers	..0	(away).
Mar. 8th..	Imperial College	..7	(Potter 5, Rutter 1, Newman 1).
	Rugby Club	..1	(away).

Cricket Club.

(*Captain :* MR. T. D. RUTTER.)

The following cricket matches have taken place since the beginning of the season.

Feb. 5th..	Imperial College XI	56 runs.	
	St. Mary's and Queen's Royal Colleges combined	141 runs	(home)
Feb. 19th..	Imperial College XI	117 runs for 5 wickets.	
	Trinidad Government Printing Office	..126 runs	(home)
Feb. 27th..	Imperial College XI	89 runs.	(home)
	Mr. F. Austin's XI	132 runs for 8 wickets.	